

2015

# AMUSEMENT RIDES SAFETY MANAGEMENT SYSTEM

Building and Construction  Authority

**Developed by: Amusement Rides Safety Department**

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Amusement Rides Safety Department  
Building Plan and Management Group  
Building and Construction Authority

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## **Introduction**

This Amusement Rides Safety Management System (ARSMS) is issued by the Commissioner of Amusement Rides Safety to provide guidance to all amusement ride owners for the implementation of an effective Safety Management System.

This ARSMS lays out the implementation of the 10 safety elements in a simplified format that is easy to understand. It is also written in a way that accommodates to the wide variety of amusement rides that can found in the industry. Examples (in green) have also been included to provide an illustrative reference to the content.

Amusement ride owners should make reference to this document in their establishment and implementation of a safety management system.

## **Definitions**

For the purposes of this document, the following terms apply.

### **Ride Owner**

The Ride Owner is the party that owns the amusement ride. In Singapore, the ride owner is also referred to as the operating permit holder which is the party that holds an operating permit issued by the Commissioner under Section 14 of the Amusement Rides Safety Act.

### **Ride Manager**

The Ride Manager is the person that has charge of the maintenance and operations aspects of the amusement ride. This person has duties to oversee, manage and supervise the daily routine operation and maintenance of the amusement ride.

### **Operator**

The operator is the person that has direct control of various functions of an amusement ride.

### **Inspection Body**

An inspection body is a party that is engaged to provide professional assessment and recommendations. The inspection body is usually a party that has expertise in the field of amusement ride engineering. In Singapore, this party could be referred to as either one of the following professionals, or both:

**Qualified person (QP):** The party that is engaged by the ride owner, who is also a registered Specialist Professional Engineer in the discipline of amusement ride engineering under the Professional Engineers Act (Cap. 253).

**Conformity Assessor (CA):** The party that is engaged by the Qualified Person, whose expertise is or includes the carrying out of procedures (including inspections, tests and certifications) for determining whether the design and specifications of an amusement ride conforms to the given technical standard or requirement.



# **Amusement Rides Safety Management System**

# **1 Safety Management System and Organisation**

## **1.1 Purpose**

This manual provides guidelines for the preparation of an amusement ride safety management system. An individual amusement ride operator's requirements may vary with the size of the company and the type of equipment it operates. The objective of this manual is to assist operators in planning, implementing and auditing their safety management system.

## **1.2 Policy Statement**

The management of amusement rides should provide the vision, establish the framework, set expectations and provide the resources for the responsible management of the amusement rides operation and upkeep. Leadership and commitment to improve amusement rides safety performance are essential for the continual improvement of the safety standards.

The policy should:

- a) Be appropriate to the nature and scale of the amusement ride risks;
- b) Make commitment to comply with legal and other requirements applicable to the organisation;
- c) Continually improve the amusement rides safety management system;
- d) Be documented, implemented and maintained;
- e) Be communicated to all employees;
- f) Be endorsed by senior management; and
- g) Reviewed periodically to ensure it remains relevant and appropriate to the organisation

The policy should also address the following:

- a) The recognition that amusement rides safety is an integral part of business performance;
- b) Accountability to the top management;

### **1.3 Organisation and Responsibilities**

The organisation shall demonstrate its commitment by:

- a) Setting up the framework for which amusement rides safety is being managed;
- b) Ensuring the availability of resources essential to establish, implement, maintain and improve the safety management system; and
- a) Allocation and delegation of duties and responsibilities from the top management to the line staff;

#### **1.3.1 Responsibility and Authority**

The responsibility, authority and the interrelation of personnel, who manage, perform and verify work affecting safety shall be defined and documented, particularly for personnel who need the authority to:

- a) Initiate action and to prevent the occurrence of any nonconformities relating to the safety management system.
- b) Identify and record problems relating to the safety system;
- c) Accord responsibilities at all levels in preventing incidents through group and personal communications
- d) Verify the implementation of solutions; and
- e) Where a deficiency or unsatisfactory practice is observed, to initiate temporary suspension until the deficiency or unsatisfactory practice has been corrected.

### **1.3.2 Resources**

The top management shall identify resource requirements and provide adequate resources, including the assignment of trained personnel for management performance of work and verification activities including safety audits and reviews.

### **1.4 Review and continual improvement**

The management of the organisation shall review the safety management system at defined intervals sufficient to ensure its continuing suitability and effectiveness. Records of such reviews shall be maintained.

### **1.5 Statutory requirements on Amusement Rides Safety**

The organisation shall identify and maintain a list of all statutory and other requirements that affects them. In Singapore, this would include the following but not limited to:

- a) The Amusement Rides Safety Act
- b) Amusement Rides Safety Subsidiary Legislations
- c) Applicable standards and codes as prescribed under the Amusement Rides Safety Regulations (Refer to example 1.1)
- d) Fire Safety Act
- e) Workplace Health and Safety Act

### EXAMPLE 1.1

#### SAMPLE OF THE APPLICABLE STANDARDS OR CODES FOR AMUSEMENT RIDES IN SINGAPORE

<i>Amusement ride</i>		<i>Applicable standard or code</i>	<i>Issuer of standard or code</i>
1.	Aerial ropeway	ANSI B77.1.	American National Standards Institute.
		CSA Z98-07.	Canadian Standards Association.
		BS EN 12929 (Parts 1 and 2).	British Standards Institution.
2.	Air-inflated enclosure	ASTM Committee F24 Standards.	ASTM International.
		BS EN 13814.	British Standards Institution.

## **2 Risk Assessment and Management**

### **2.1 General**

Risk is the combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or health that can be caused by the event or exposure(s).

Risk assessment is the processes of evaluating the risk arising from hazard, taking into account the adequacy of any existing controls, and deciding whether the risk is acceptable.

An acceptable risk is a risk that has been reduced to a level that the organisation is willing to assume with respect to its legal obligation, its safety policy and objectives.

The organisation shall establish, implement and maintain procedures for identifying hazards, analysing all existing and potential risks, and determining the necessary controls

### **2.2 Risk Assessment Plan**

The organisation shall establish a hazard identification and risk assessment plan which includes the following:

- a) Formation of a risk assessment team that should consist of the ride manager, the person in charge of the ride, and at least one staff each from the maintenance and operation teams;
- b) Details of the duties and responsibilities of the team members;
- c) Risk assessment methodology to be used;
- d) Risk assessment report;
- e) Implementation of control measures;
- f) Regular review of the risk assessment; and
- g) Review as necessary after an incident or after having knowledge of similar incidents for a particular ride. (Refer to Example 2.1)

### **EXAMPLE 2.1**

#### **REVIEW OF PLAN AFTER AN ACCIDENT**

- i) Description of Incident:
- ii) Cause of Incident:
- iii) Effect on Severity and Likelihood:
- iv) Mitigating Measures:
- v) Revised Severity and Likelihood after measures:
- vi) Update Risk Assessment Table:

### **2.3 Risk Assessment Method**

The risk assessment method shall include the following:

- a) Identification and records of existing and potential hazards and risks (refer to Example 2.2);
- b) Indication of the levels of the risks related to the hazards;
- c) Identification of the personnel exposed to the risks;
- d) Analysis and assessment of the risk involved;
- e) Elimination or mitigation of the risk;
- f) Determination of the competency requirements for implementing the controls

## EXAMPLE 2.2

### Potential Hazards

Hazard	Possible sources of hazard
Persons struck by falling, ejected or other objects	<ul style="list-style-type: none"><li>• Patrons' belongings</li><li>• Mechanical / structural or other parts coming unfastened or failing in service (including backdrops)</li><li>• Tools</li><li>• Ejected patrons / employees</li><li>• Other projectiles</li></ul>
Nausea, physical injury resulting from intensity, direction and duration of accelerations and jerks (i.e. change of accelerations)	<ul style="list-style-type: none"><li>• Forces of motion on patrons</li><li>• Padding and cushion</li></ul>
Hazards associated with patron containment including –  a. unplanned release of locks  b. Ill-fitting restraints	<ul style="list-style-type: none"><li>• Design of locks and restraints</li><li>• Failsafe mechanism in the locks</li><li>• Padding at patron-restraint contact points</li><li>• Patron size specification</li></ul>



## **2.4 Risk Assessment Report**

The Risk assessment report (refer to Example 2.3) shall include the following:

- a) Records of all existing and potential risks
- b) Analysis of the risks; and
- c) Development and implementation of control measures

## EXAMPLE 2.3

### A Risk Assessment Report

Inventory of Work Activities Form: Rollercoaster – Operations																
#	Location	Purpose			Activity scope				Remarks							
1	Unloading platform	Assisting guests			Standing in position at the guest unloading area											
2	Unloading platform	Unloading guests from ride vehicle			Moving around ride area to complete tasks											
3	Unloading platform	Start-up and shut-down of the ride system			Using electrical equipment											
Risk Assessment form																
Department		Operations		RA leader		Albert		Sign		Approved by		Reference # FBY/XF/SFD/NG/DT /AO/RA/TT12/1.1				
Activity		Unloading guests		#1		Brian				Sign						
Activity location		Unloading platform		#2		Charlie				Name						
Original RA date		20-11-2011		#3		Delfi				Designation						
Last Review date		21-02-2012		#4		Esme				Date						
Next Review date		23-01-2013		#5		Freda										
Hazard Identification				Risk Evaluation						Risk Control						
#	Work activity	Hazard	Possible injury/ill health	Existing risk controls			S	L	RL	Additional risk control		S	L	RL	Imple- mentation person/s	Due date
1	Standing in position at the guest unloading platform	Standing for long periods exposed to heat, rain, or other inclement weather	Nausea, headache, fatigue, body aches	- Shelter provided - Team members are reminded to hydrate themselves frequently - Frequent rotation of positions			2	2	4	- Provide waterbottles - Provide electric fans		2	1	2	Gretel, Hansel	01-03-2012
2	Moving around ride area to complete tasks	Slips, trips, and falls	Bodily injury	- On-the-Job Training - Position of operating console keeps operator away from fall hazard			3	2	6	Install Safety Lines to create awareness of fall hazard		3	1	3	Ignatius, Jay	11-03-2012
3		Contact with moving components	Bodily injury, or possible death	- On-the-Job Training - Working Instruction Procedures - Station Stop - Emergency Stop Button - Two Action Start-up - CCTV Coverage - Annual Training Re-certification - Position of operating console keeps operator away from moving components			3	2	6	Set up Safety Infraction Tracking & Follow-up System		3	1	3	Kay, Lysa	11-03-2012
4	Using electrical equipment	Electrocution	Death, burns, or damage to nervous system	- On-the-Job Training - Daily Tech Inspections. - Working Instruction Procedures			3	1	3	Nil		-	-	-	-	-

### EXAMPLE 2.3 (Continued)

#### Legend – Risk Assessment

Low = 1-2

Minor – Lower Priority for controls after higher priorities

Medium = 3-5

Moderate – Medium priority for control as soon as possible.

High = 6-9

Serious or significant– a high priority for immediate controls elimination.

S – Severity of Injury	L – Likelihood of Occurrence
1 – No injury or light injury requiring no more than first aid	1 – Improbable
2 – Serious Injury that require hospital care	2 - Possible
3 – Fatality or permanent disability	3 - Probable

3	3	6	9
2	2	4	6
1	1	2	3
S L	1	2	3

## 2.5 Controls

When determining controls or considering changes to existing controls the organisation can consider the following hierarchy to manage the risks (refer to example 2.4);

- a) Elimination
- b) Substitution
- c) Engineering controls
- d) Administrative controls; such as procedures like signages and warnings and
- e) Personal protective equipment

### EXAMPLE 2.4

#### Control Measures

**Case example:** Patron falls out of seat when the amusement ride undergoes high speed or manoeuvres.

S/N	Type	Control measures
1	Elimination	Redesign the ride to remove all high acceleration movements
2	Substitution	Nil
3	Engineering controls	Install a class 5 restraint system for the seat to hold patrons in place during high acceleration
4	Administrative controls	Operators are trained on proper loading of patrons and securing of restraints
5	Personal protective equipment	Patrons are provided with protective clothing such as helmet and soft-padded suits to cushion the patrons' impact with hard surfaces when they fall off the ride

### **3 Operational Safety**

#### **3.1 General**

The organisation shall establish and maintain procedures for the safe operations of amusement ride activities. These procedures shall be fully documented.

#### **3.2 Standard Operating Procedures**

The organisation shall establish a set of standard operating procedures with reference to the specifications set by the designer or manufacturer of the amusement ride. The procedures shall set out clear instructions for the following areas:

- a) Operation checks for pre-opening, during operations and closing
- b) Duties for operational supervision
- c) Patron Management
- d) Incident Management
- e) Adverse weather (refer to Example 3.1)
- f) Siting and Relocation

### EXAMPLE 3.1

#### Procedures during inclement weather

##### Inclement Weather Procedure

1. In the event of inclement weather, wait for instructions from the Duty Supervisor/Duty Manager before suspending the ride.
2. Stop loading and inform guests using the <Inclement Weather Announcement>
3. Politely but firmly ask guests to proceed to the nearest designated shelter in a calm and orderly manner
4. Lock the gates at the entry point of the queue line.
5. Put up the <Inclement Weather Announcement> signboard beside the entry point.
6. The ride operators should be the last to leave the ride, after ensuring all guests have cleared the ride area.
7. Instructions will be given to the ride operators to return to their positions and resume the ride.

##### *<Inclement Weather Announcement>*

*Ladies and gentleman, we are suspending this ride for safety reasons because of the bad weather. We shall resume once the weather conditions are suitable.*

*Thank you for your patience and understanding.*

#### 3.2.1 Duties for Operational Supervision

The ride manager shall provide adequate systems and procedures to ensure:

- a) Supervision on any amusement designed for intended use, either direct or indirect (e.g through remote monitoring) at all times when ride is in use;
- b) Minimum number of required operators in charge of operating an amusement ride at any one time are on duty;

- c) Operators are adequately trained and all essential information for safe operation are available; and
- d) Operators are identifiable to the members of the public

### **3.2.2 Documentation**

The ride manager shall minimally provide the following documents which should be readily available at all amusement rides:

- a) Operating Manual;
- b) Log Book for recording of all incidents, maintenance, modification or repairs; and record of failures / accidents (Refer to Example 3.2 for an example on an incident log)
- c) Standard Operating Procedures

## EXAMPLE 3.2

### Incident Log

INCIDENT LOG	
<b>1) General details – Date and Incident Location</b>	
Name of Ride, ARN:	
Date of incident:	
Time of incident:	
Theme Park:	
Address:	
<b>2) Account Of Incident</b>	
Death: <input type="checkbox"/> Yes <input type="checkbox"/> No	Injury: <input type="checkbox"/> Yes <input type="checkbox"/> No
Evacuation: <input type="checkbox"/> Yes <input type="checkbox"/> No	Fire: <input type="checkbox"/> Yes <input type="checkbox"/> No
Derailment: <input type="checkbox"/> Yes <input type="checkbox"/> No	Collision: <input type="checkbox"/> Yes <input type="checkbox"/> No
Structural/Mechanical/Control System/Electrical Fault: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Restraint Failure: <input type="checkbox"/> Yes <input type="checkbox"/> No	Others:
Details (Supplement with photographs):	
<b>3) Injured person(s)</b>	
Name and role of injured person 1:	Contact Number:
Injury and other details:	
To add if more:	
<b>4) Staff involved</b>	
Name of staff 1:	Contact Number:
Role / responsibility:	



To add if more:

**5) Other Personnel involved**

Name of person 1:

Contact Number:

Role / responsibility:

To add if more:

**6) Particulars of Ride Manager or Liaison Officer**

Name:

Contact Number:

**7) Authority to be alerted**

**8) Description of investigation**

Details:

**9) Cause or probable cause:**

Details:

**10) Measures to mitigate future accidents**

Details:

**11) Recommendations and Follow Up**

☐ Close case

☐ Further investigation required

☐ Repairs needed

☐ Suspend ride

☐ Details/Others (elaborate):

### 3.2.3 Out of Operation

The ride manager shall provide adequate system and/or procedures with reference to the manufacturer or designer's recommendation to ensure the safe isolation and prevention to the unauthorised use of the amusement ride when it is out of operation (refer to Example 3.3).

#### EXAMPLE 3.3

##### Shut Down Procedure

##### Shut Down

Before shutting down the ride:

- One train is 'at good position' in the station; the other train is in the storage area or in the trim area.
- Both trains are in the storage area.

##### Note

The actions below must be carried out using operator control console 10X51

1. Turn the Restraints switch (4) to 'Lock'
2. Close all restraints
3. Turn the Entrance gates switch (2) to 'Close'
4. On the left display, log in as 'maintenance' or 'inspection' (enter password when prompted)
5. Close the program
6. Push E-Stop (2)
7. Turn off the main switches on the main control cabinets (X51) and the ride control cabinet (FX1).
8. Remove all keys from the cabinets and consoles.

### **3.2.4 Siting of amusement rides**

The ride manager shall ensure that the amusement ride is only sited on ground which is suitable for this purpose in accordance with the manufacturer's recommendations and applicable statutory requirements.

The following shall be considered among others:

- a) That the ground can safely bear the load of the amusement ride. For existing structures or buildings, calculation shall be carried out in order to ensure the ride does not exceed the floor's permissible load. An inspection of the structure should also be carried out to ensure it does not have cracks or damage that may affect the safe operation of the ride.
- b) That the ground is sufficiently flat, even and stable for the ride to be assembled and used on safely, in accordance with the manual
- c) That the ground is checked at regular intervals after build up and to confirm that there is no deterioration in its load bearing capacity, especially during and after adverse weather conditions.
- d) To establish the positions of underground services or overhead lines that may present hazards during the assembly or operation of the device and to take reasonably practical precautions for the prevention of such hazards.

## **4 Maintenance**

### **4.1 General**

The organisation shall establish an effective maintenance program to ensure safe and efficient operation of all amusement ride related devices and equipment.

All maintenance work on an amusement device shall be carried out by, or under the direct supervision of, persons trained or experienced in the maintenance procedures appropriate to that ride/device. These procedures shall include preventive maintenance and component monitoring, taking into account any instructions from, or consultation with, the manufacturer of the amusement device and the independent inspection body.

All guards, fences, equipment enclosures and access doors, which are removed for servicing or maintenance purposes, shall be replaced and effectively secured in position before the device is set in motion.

### **4.2 Maintenance program**

The organisation shall implement an effective maintenance program which shall include:

- a) Listing of all amusement rides related devices and equipment;
- b) Schedule of inspection and maintenance;
- c) Procedure for breakdown and repair; and
- d) Record of inspection and maintenance;

#### **4.2.1 Schedule of inspection and maintenance**

The organisation shall ensure that all amusement rides related devices and equipment are inspected and maintained in accordance with statutory requirements and manufacturer's recommendations. A schedule of inspection and maintenance shall be documented and maintained.

Defects and malfunctions identified during the inspection shall be documented and brought to the attention of the authorised personnel for corrective action such as repairs. The ride manager would responsible for overseeing the required certification of all equipment.

#### **4.2.2 Procedures for breakdown and repair**

The organisation shall establish procedures for breakdown and repair of the amusement ride and its related devices and equipment which shall include the following:

- a) Identify and record all defects and malfunctions;
- b) Ensure that all repairs are carried out by authorised competent persons and conform to statutory requirements and manufacturer's recommendations.
- c) Display warning signs and notices at the amusement ride related devices and equipment that are not in an operationally ready state (e.g. in the progress of repair or overhaul)
- d) Ensure that all amusement rides undergoing repairs be prohibited from use; and
- e) Ensure that all repaired amusement rides and equipment are certified by the Ride Manager prior to re-use.

#### **4.2.3 Lockout - Tagout Procedures**

Lockout – Tagout (LOTO) is a safety procedure used to prevent the accidental activation of hazardous energy or machines that could cause danger to the staff prior to the completion of any maintenance or servicing work (*Reference can be made to SS 571:2011, Code of Practice for Energy lockout and Tagout*). Lockout is the isolation of energy from the system by means of a physical lock while Tagout is a labelling process that is used together with the lockout to indicate certain information. (Refer to Example 4.1)

The organisation shall establish the appropriate Lockout/Tagout (LOTO) procedures to ensure that machines are properly shut off to a safe mode and do not pose any danger to their staff during maintenance.

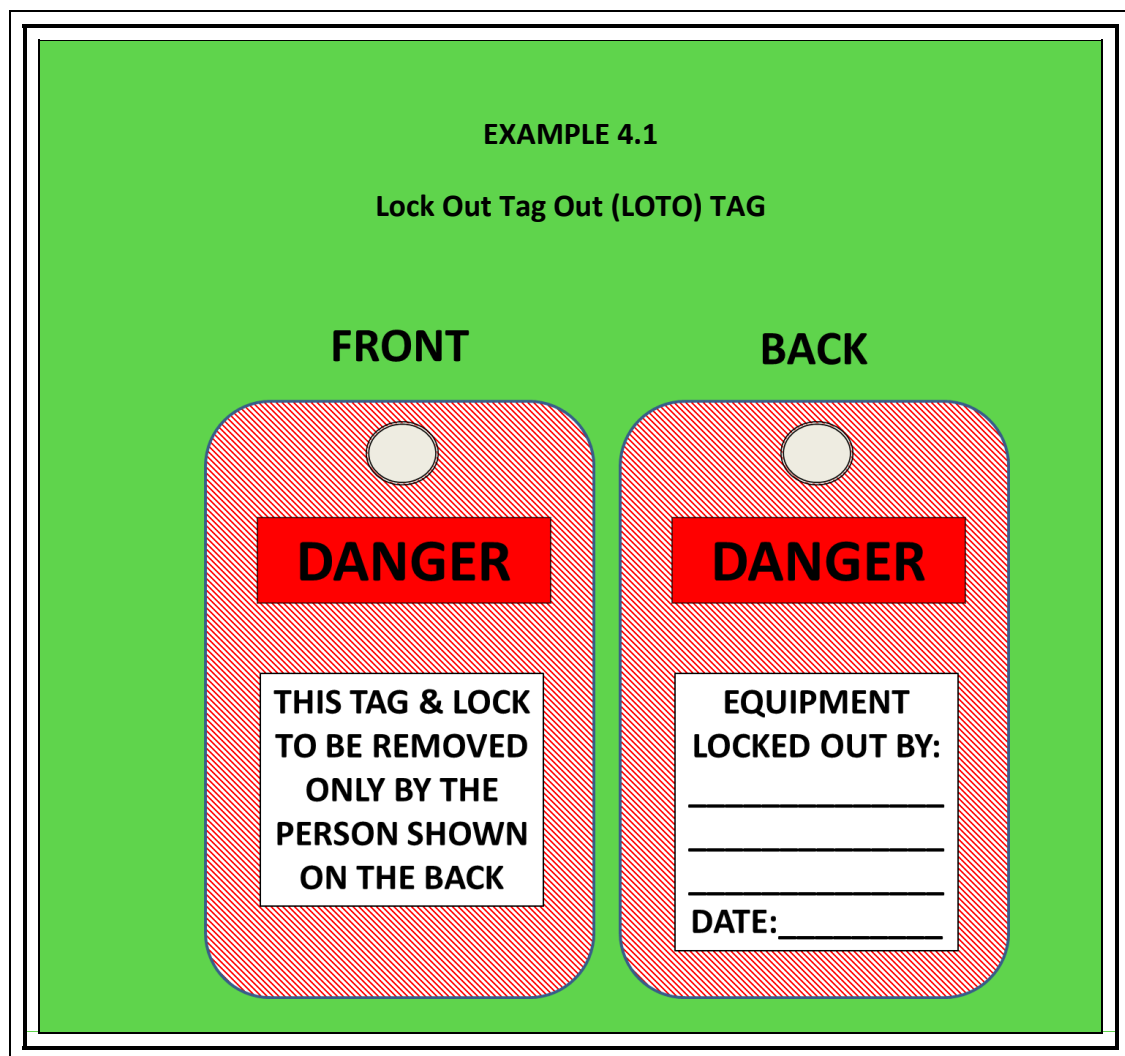
The LOTO procedures should specify the following but not limited to:

- a) The affected and authorised persons
- b) Tools used in the shutdown or isolation
- c) The specific machine, equipment or process shutdown and isolation processes
- d) Location and storage of the lockout devices

- e) Process of controlling and de-energizing stored energy
- f) Verification of the isolation or shutdown
- g) Notification of the isolation or shutdown

The information displayed on the label(s) during Tagout should also include the following but not limited to:

- a) Purpose of the LOTO
- b) Time details of the application of the LOTO
- c) Name(s) of the authorized person who attached the tag and lock to the system



#### **4.2.4 Records of inspection and maintenance**

The organisation shall document and maintain records of all inspections, maintenance, breakdowns and repairs carried out including maintenance and repairs by external agents.

### **4.3 Servicing**

All equipment shall be maintained in accordance with manufacturer's manual(s) and / or good engineering practices.

The servicing intervals recommended by the manufacturer shall not be exceeded, unless any extension in the period has been agreed and approved either by the manufacturer in writing or with the approval of the appointed inspection body. The frequencies at which servicing is carried out shall be in compliance with manufacturer's recommendations. All components that have to be checked, tested, adjusted or replaced at specified intervals shall follow servicing recommendations.

Where necessary these recommendations shall take into account information from:

- a) Diagrams of the mechanical, electrical, hydraulic, pneumatic, safety and security systems;
- b) Instructions concerning the actions to be taken when checking, testing, lubricating, adjusting or replacing and dismantling or assembling of components;
- c) Specifications of the required condition of the parts in question, and permitted deviations;
- d) Specifications of the components and materials;
- e) Specifications of the lubricants to be used;
- f) The intervals at which the various checks and servicing work shall be carried out.

The ride manager shall ensure that replacement parts fitted during servicing operations are of the correct specification. If it becomes necessary to use replacement parts which are different from those specified by the manufacturer the ride manager shall treat these changes as a modification and proceed as detailed in section 4.5

#### **4.4 Repair**

The repair of damaged parts shall be carried out with caution, as this could lead to a departure from the approved original design.

After a repair, a device may not be used until:

- a) Every repaired part has been checked against the specification and/or procedure. If there are differences the repair shall be treated as a modification;
- b) If any welding or hot work is done, the correct materials and techniques shall have been verified so that the integrity of the device is not adversely affected.

Defects in any safety related components shall not be repaired without first consulting the manufacturer or an independent inspection body. The manufacturer/designer, where possible, shall be informed so that causes can be investigated and remedied. The manufacturer/designer shall make any recommendation as necessary regarding the repairs and/or safe operating conditions.

#### **4.5 Modification**

Before modifying any device, the ride manager shall ensure that the proposed modification will be safe. A Risk Assessment (refer to Element 2 on Risk Assessment) may be necessary to determine whether the modification is safety related. If in doubt, the modification shall be treated as safety related.

A safety related modification includes any change to the following:

- a) Loading (e.g. changing seating arrangements, fitting heavier passenger units)
- b) Speed or operating cycle;
- c) Range (e.g. height of lift);
- d) Safety envelope;
- e) Structural and mechanical components;
- f) Drive mechanisms;
- g) Control mechanisms (e.g. brakes, shock absorbers, speed limiters, speed or position sensors);



- h) Ride Controls;
- i) Passenger containment (including fencing and barriers);
- j) Passenger height and weight restrictions

A safety-related modification also includes;

- a) Use of a device outside its specification or normal environment for which it was designed;
- b) Re-installation of a fixed device in a different location.

The advice of the original designer or an inspection body shall be sought where a modification is safety related.

Any safety related modification will require statutory approval and notification which would include a design review and an assessment of conformity.

## **4.6 Inspection**

All amusement ride devices in use shall be thoroughly inspected by an independent inspection body annually or at shorter intervals determined by statutory requirements.

The purpose is for a service inspection to determine the condition of the amusement device and also a check on the safety related components for continued further use during its operational life.

### **4.6.1 Inspection process**

(Refer to Example 4.2)

The inspection process shall include the following but not limited to:

- a) Identifying the critical components and recommended inspection methods which could include visual and non-destructive testing (4.6.2). The ride manager and the inspection body shall agree on the items to be inspected;
- b) Counter checking and identifying any safety related components that has a history of irregularities(unusual wear or damage) or incident records

- c) Disassembly and exposure of safety critical components where required by the manufacturer or the operating manual or based on the judgement of the independent body.
- d) Checks for damaged, cracked or missing structural members which may impair the load carrying capacity
- e) Checks on components for excessive wear, internal/external corrosion and cracking;
- f) Checks on the state and function of all passenger restraints and their locking systems
- g) Checks on leaks for any hydraulic or pneumatic components that are used for any form of ride support or elevation. Pressure settings of safety or pressure control valves should also be checked.
- h) Checks on electrical cables and electrical components such as circuit breakers, contactors, relays and residual current circuit breakers for burnt marks and visible damages. The operating time and current of residual current circuit breakers should be measured and recorded to monitor the condition of the devices. The earth loop impedance of the ride electrical system and grounding for all metal frames used for the ride should also be measured. In addition, the lightning conductor system for the ride should be checked and tested (especially for outdoor rides).
- i) Observations on the operational testing and functional tests
- j) An inspection report by the independent inspection body detailing records and results of the tests conducted.

## EXAMPLE 4.2

### Inspection Checklist for Amusement Rides

*(From the 'Annual Inspection Guide for Amusement Rides in Singapore 2011')*

Ride Name: \_\_\_\_\_ Date: \_\_\_\_\_ to \_\_\_\_\_

Amusement Ride No.: \_\_\_\_\_ Location: \_\_\_\_\_

No.	Section in Guide	Points of Inspection	S=Satisfactory, U=Unsatisfactory	Remarks, if any
Foundation and Structural Elements				
1	5.1	Foundation and its surrounding soil condition		
2	5.1	Structural elements (inclusive of tracks)		
3	5.1	Footings (for relocatable rides only)		
4	5.1	Check that ride is level (for relocatable rides only)		
Wire Ropes, Chains and their Accessories				
5	5.2	Condition of wire ropes and accessories		
6	5.2	Condition of chains and accessories		
Pressure Vessels and Accessories				
7	5.3	Condition of pressure vessels		
8	5.3	Condition of air compressor		
Welds and Joints				
9	5.4	Condition of welds		
10	5.4	NDT checks on welds, if any		
11	5.4	Condition of joints (inclusive of tightness check)		
Patron Restraints				
12	5.5	Condition of patron restraints		
13	5.5	Safety interlocks of seat restraint systems		
Patron Containment and Safety Envelope				
14	5.6	Condition of patron containment system		
15	5.6	Check on wheels and bearings		
16	5.6	Check on patron safety envelope		
Electrical Components				
17	5.7	Integrity of electrical installation		
18	5.7.1	Condition of cables and connecting devices		
19	5.7.2	Integrity of earthing and bonding arrangements		
20	5.7.3	Condition of lighting		
21	5.7.3	Condition of emergency lighting		

Control System				
22	5.8	Check on control system		
Mechanical Components				
23	5.9.1	Condition of hydraulic system		
24	5.9.1	Condition of pneumatic system		
25	5.9.2.1	Condition of drives		
26	5.9.2.1	Condition of drive tyres and its pressure		
27	5.9.2.2	Condition of brakes		
28	5.9.2.3	Condition of damping system and shock absorbers		
Safety Equipment				
29	5.10	Condition of safety equipment (anti-roll back, E-stop, redundancy system)		
Miscellaneous				
30	5.11.1	Condition of guards, barriers and fencing		
31	5.11.2	Condition of platforms, ramps, floors and walkways		
32	5.11.3	Signage		
System Checks				
33	6	Check review of risk assessment is conducted and risk assessment up-to-date		
34	6.1	Original reports (design and specifications, risk assessment and commissioning tests)		
35	6.2	Check operation manual updates are available		
36	6.3	Adherence to maintenance manual		
37	6.4	Check on maintenance records		
38	6.5	Check on manufacturer's stated inspection requirements		
39	6.6	Check log book completeness		
Functional Tests				
40	7	Conduct functional tests		

#### 4.6.2 Non-destructive testing

Visual examination may need to be supplemented by other non-destructive testing (NDT) techniques at the recommendations of the inspection body or manufacturer to comply with statutory requirements. The ride manager and the inspection body should agree on the appropriate NDT method to be used.

Non-destructive testing shall be carried out by certified personnel and the reports reviewed by the inspection body.

Following are a list of the more commonly used NDTs and their brief descriptions:

a) Penetrant Testing (PT) (refer to Example 4.3)

PT is a process where a liquid penetrant is applied to a section of material where a surface defect is suspected. Due to the capillary effect, the penetrant would seep into any surface-breaking discontinuities. Upon application, the excess penetrant is removed and a developer is applied to draw out the penetrant such that the flaw becomes visible. Dye Penetrant Testing is usually used for materials that have a relatively smooth, non-porous surface.

b) Magnetic Particle Inspection (MPI) (refer to Example 4.3)

MPI is a process where iron particles coated with a dye pigment are applied to a ferromagnetic material. Upon the presence of a strong magnetic field, the particles would be attracted to leakage fields caused by any discontinuity in the material and cluster to form an indication over it. This indication would then be interpreted by a trained inspector. MPI is a relatively fast method of inspection and is able to inspect parts with irregular shapes easily.

c) Ultrasonic Testing (UT)

UT is a process that uses high frequency sound energy to propagate through the test material. If there is a presence of a discontinuity in the wave path, part of the energy is reflected back and transformed into an electrical signal which is analysed by a trained inspector. UT can be used for flaw detection and evaluation and is able to detect extremely small flaws due to its high sensitivity.

### EXAMPLE 4.3

## Dye Penetrant Testing (PT) Report

### REPORT OF VISUAL AND DYE-PENETRANT EXAMINATION

Project \_\_\_\_\_

Quality requirements—section no. \_\_\_\_\_

Reported to \_\_\_\_\_

#### Weld Location and Identification Sketch



Weld drawing no. \_\_\_\_\_

Base alloy(s) \_\_\_\_\_

Filler alloy \_\_\_\_\_

Postweld treatment \_\_\_\_\_

Dye-penetrant type \_\_\_\_\_

(Describe length, width, and thickness of all joints radiographed)

Date	Weld Identification	Area	Interpretation		Repairs		Remarks
			Accept	Reject	Accept	Reject	

We, the undersigned, certify that the statements in this record are correct and that the welds were prepared and tested in accordance with the requirements of AWS D1.2/D1.2M, *Structural Welding Code—Aluminum*.

### EXAMPLE 4.3 (Continued)

## Magnetic Particle Testing (MPI) Report

### REPORT OF MAGNETIC-PARTICLE EXAMINATION OF WELDS

Project \_\_\_\_\_

Quality requirements—Section No. \_\_\_\_\_

Reported to \_\_\_\_\_

### WELD LOCATION AND IDENTIFICATION SKETCH

Quantity: \_\_\_\_\_ Total Accepted: \_\_\_\_\_ Total Rejected: \_\_\_\_\_

Date	Weld identification	Area Examined		Interpretation		Repairs		Remarks
		Entire	Specific	Accept.	Reject	Accept.	Reject	

#### PRE-EXAMINATION

Surface Preparation: \_\_\_\_\_

#### EQUIPMENT

Instrument Make: \_\_\_\_\_ Model: \_\_\_\_\_ S. No.: \_\_\_\_\_

#### METHOD OF INSPECTION

☐ Dry ☐ Wet ☐ Visible ☐ Fluorescent

How Media Applied: \_\_\_\_\_

☐ Residual ☐ Continuous ☐ True-Continuous

☐ AC ☐ DC ☐ Half-Wave

☐ Prods ☐ Yoke ☐ Cable Wrap ☐ Other \_\_\_\_\_

Direction for Field: ☐ Circular ☐ Longitudinal

Strength of Field: \_\_\_\_\_

(Ampere turns, field density, magnetizing force, number, and duration of force application.)

#### POST EXAMINATION

Demagnetizing Technique (if required): \_\_\_\_\_

Cleaning (if required): \_\_\_\_\_ Marking Method: \_\_\_\_\_

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared and tested in conformance with the requirements of AWS D1.1/D1.1M, (\_\_\_\_\_) *Structural Welding Code—Steel*.

Inspector \_\_\_\_\_ Manufacturer or Contractor \_\_\_\_\_

Level \_\_\_\_\_ Authorized By \_\_\_\_\_

Test Date \_\_\_\_\_ Date \_\_\_\_\_

## **4.7 Contractor Selection and Management**

Management of contractors is an important area of quality control as some expertise may not be available in-house or it could be due to reasons such as being more cost effective. For the purpose of this ARSMS, the contractors referred to can include either suppliers of fabricated materials or components, or contractors for ride maintenance or operation.

Where the ride maintenance or operation is done by a contractor, the organisation shall establish procedures to evaluate the contractors' competency. The result of these evaluations shall be used as criteria in the selection of the contractors.

The organisation should consider the following as much as possible to gauge the contractor's suitability especially if it is a long term arrangement:

### **a) Contractor qualification and selection**

The ride owner should list down the qualifications and expertise of the contractor required for the job, such as the contractor's track records. For example, certain rides will require non-destructive testing on a regular basis. The ride owner may not have in-house expertise for NDT testing and has to subcontract the work to another company. In such a case, the operator should list down the qualifications and certifications that are required for the personnel to carry out the tests as specified by the manufacturer of the ride.

### **b) Contractor evaluation**

Once the contractor has been identified and engaged, the supplier's performance based on a set of matrices should be evaluated on a regular basis. For example, site visits to the contractors' factory floor can be arranged to audit the processes, quality, competency and training records of the managers, supervisors and workers.

### **c) Risk evaluation**

The ride owner should carry out assessment on the internal and external factors that will affect the relationship between the company and the contractor. For example, the contractor may be a sole fabricator for a replacement component used for a ride but is on weak financial standing. This may affect the supply of such parts to the ride owner in the future and eventually affect the operability of the ride.

### **d) Supplier development**



The ride owner should work with the contractors closely to meet agreed-upon improvements. Safety records of acceptable sub-contractors should be maintained by the operator.

## **5 Training and Selection of Personnel**

### **5.1 General**

While having suitable and competent staff is the result of proper selection and training, it also involves regular monitoring, auditing, and having a system of personnel records. The organisation has to select people who are able to put the safety of the public first and their propensity to follow procedures conscientiously. The personnel to be selected should also have the appropriate skills and maturity to carry out the job tasks that the organisation requires of them. Training methods should be tailored to the capabilities of those being trained.

### **5.2 Maintenance Crew**

The maintenance crew will be responsible for maintaining the ride components.

#### **5.2.1 Selection of Maintenance Crew**

The maintenance crew should have the following attributes:

- a) Be of the legal working age according to the local statutory requirements; and
- b) Have previous technical experience working as maintenance crew or have trade qualification in carrying out the maintenance and works of the ride components.

If the personnel have no technical working experience prior to joining the organisation, an on-the-job-training program beside the training program listed in section 5.2.2 should be conducted for the personnel before he/she is allowed to carry out the maintenance task independently.

#### **5.2.2 Training Programme for Maintenance Crew**

The program shall include trainings on the following:

- a) Understanding the technical information of the ride such as components specification and drawings;
- b) Understanding how the ride functions;
- c) Understanding the design risk assessment of the ride;

- d) Instruction on the preventive maintenance procedure ;
- e) Procedure for dealing with defects and malfunctions of equipment;
- f) Instruction on methods of installation of the ride components;
- g) Instruction on regular inspections and function testing of the rides;
- h) Understanding the requirements of the local statutory law for the safe operation of the ride and the standard which the ride is required to comply with regards to maintenance; and
- i) Briefing on all assigned duties and roles in the maintenance team.

### **5.3 Operators and Dispatchers**

The operators and dispatchers will be responsible for ensuring the safe and smooth operation of the amusement rides.

#### **5.3.1 Selection of Operators and Dispatchers**

The operators/dispatchers should have the following attributes:

- a) Be of the legal working age according to the local statutory requirements;
- b) Able to follow general procedures (Standard operating procedures and procedures to operate machines) and instructions conscientiously;
- c) Able to show competency in controlling crowd;
- d) Able to give clear instructions to the patrons; and
- e) Have good observation skills.

#### **5.3.2 Training Programme**

(Refer to example 5.1)

A training program for the operators and dispatchers shall include the following

- a) Instruction on pre start-up operational ride checks as require by manufacturer;
- b) Instruction on ride control;

- c) Instruction on loading and unloading of patrons onto the ride vehicles (Refer to example 5.2);
- d) Instruction on passenger restrictions such as height and weight limits or medical condition;
- e) Controlling of waiting and viewing areas;
- f) Use and operating of passenger containment and passenger restraint systems including the checking of restraint closure;
- g) Knowledge of the use and function of all normal and emergency operating controls and the proper use of the ride;
- h) Instruction for dealing with misbehaving patrons or those not qualified to take the ride (e.g. drunk, unable to meet height requirements);
- i) Procedure for adverse weather;
- j) Procedures for emergencies such as fire and patron injuries;
- k) Procedures for dealing with and reporting of malfunctions of equipment; and
- l) Briefing of all assigned duties and roles in the operation team.

## EXAMPLE 5.1

### Sample Training Checklist – Operations Crew

Name of employee: \_\_\_\_\_

Designation: \_\_\_\_\_

Training start date: \_\_\_\_\_

NOTE: It is required for the employee to complete all training modules as specified in this training programme before he is allowed to work on the ride.

*<Note: The following table is provided as an example and the list of items is not exhaustive>*

Item	Date Trained	Name and Signature of trainer	Signature of employee
<b>Module 1 - Safety</b>			
Basic orientation of ride			
Location of control panel(s)			
Location of emergency stop, power switches/buttons			
Reading and understanding risk assessment			
Understanding of risks at work			
Knowledge of work schedule, break times and roster			
Understanding individual roles and responsibilities			
<b>Module 2 – Ride information</b>			
Know and understand the rules of operation			
Knowledge of weather conditions that ride can operate			
Proper instructions to patrons			
Emergency procedures			
<b>Module 3 – Loading and Unloading</b>			
Proper instructions to patrons			
Checking of restraints			
Checking that restraints are properly secured on patrons before the ride commences			
Knowledge of the operation of control panel: <ul style="list-style-type: none"><li>• Start</li><li>• Stop</li><li>• Emergency stop</li><li>• Common error codes</li></ul>			

Module 4 – Emergency Procedure			
Ride emergency procedures on stoppage of rides, fire, injuries			
Use of safety equipment during emergency evacuation			
Knowledge of handling distressed patrons			
Location and use of first aid boxes			
Informing supervisor and calling relevant authorities			
Module 5 - Documentation			
Knowledge of pre-operations log book			
Knowledge of pre-operations check list			
Knowledge of incident log book			
<p style="text-align: center;"><b><u>Statement of Understanding and Responsibility</u></b></p> <p>I hereby acknowledge that I have received full instructions of all the training modules and I fully understand all aspects of the amusement ride operating procedures and manuals.</p> <p>Employee: _____</p> <p>Signature: _____</p>			

## **EXAMPLE 5.2**

### **Instructions on Loading of Patrons**

#### **1) Introduction**

Loading of patron is an important part of the ride experience. It is important to ensure that the patron restraint is secured properly as the safety of the patron can be greatly compromised if it is not secured properly.

#### **2) Information on safety requirements**

- Ensure patron is not intoxicated
- Ensure patron is of minimum height of 1.2m and weight of 40 kg
- Minimum age of patron is 12 years old and minors should be accompanied by a parent or legal guardian
- Ensure patron has removed everything from their pockets and do not have loose objects on them.
- Patron does not have any pre-existing heart illnesses as this is a ride which the patron may experience high G forces

#### **3) Procedure – Before loading**

- Be polite and greet the patrons with utmost courtesy
- Before guiding the patron up onto the ride, repeat the safety instructions:
  - “Please remove everything from your pockets and ensure there are no loose objects”
  - “As this is a ride which the patron may experience high acceleration forces, you are not advised to take the ride if you have any heart illnesses.
- Check the indemnity form for the age. Patron must be 12 years or older.
- Check the weight and height of the patron behind the form as this would be indicated by the counter staff.

#### **4) Procedure – During loading**

- Guide the patron to the seats
- Ensure they are sat back and upright
- Check that the restraint straps are not twisted
- Bring the straps to the buckle and ensure that it is fastened
- Adjust the strap so that it is comfortably tight
- Pull the strap lightly to check that the buckle is secured

## **5.4 Quality Control Inspectors for Checking Maintenance of Ride Components**

The quality control inspectors will be responsible for carrying out the audits on the maintenance works of the maintenance crew. They will provide an additional oversight of checking for defects which the maintenance crew may have missed during their work process. The job of the inspectors may be carried out by the experienced technical staffs of the organisation or external contractors who have the attributes listed in section 5.4.1

### **5.4.1 Selection of Quality Control Inspectors**

(Refer to example 5.3)

The quality control inspectors should have the following attributes:

- a) Possess technical experience or knowledge of maintaining and inspecting amusement rides; or
- b) Possess engineering qualification related to carrying out the maintenance works and inspections of the ride components
- c) Possesses the competency to audit training programmes



### EXAMPLE 5.3

#### Quality Control Inspector

##### Example of qualification and experience

###### Education Qualifications:

- Diploma or degree in a technical field such as mechanical engineering, electrical engineering or material science

###### Practical experience:

- Minimum 2 years' experience in a supervisory position

###### Others:

- Knowledge of Workplace Safety & Health laws & regulations
- Knowledge of Fire safety laws and regulations
- Knowledge of ISO 9001

## 5.5 Roles of Ride Manager

The ride manager shall be responsible for the operation and maintenance of the ride.

In Singapore, his duties and responsibilities will include the following:

*(Referred from the Amusement Rides Safety Regulations 2011)*

- Ensure a thorough inspection of the amusement ride is carried out in accordance with the operations manual and that the ride is in a safe working condition before it is open for use by the public each day;
- Ensure that only persons who have been sufficiently trained to operate the amusement ride are permitted to operate the amusement ride;
- Ensure that no person is permitted to operate the amusement ride or assist in the operation of the amusement ride unless such person has been properly instructed on his role in the operation of the amusement ride, the risks to which he may be

exposed, the measures that he has to take and the emergency procedures that he has to follow in the event of an adverse incident occurring in respect of the amusement ride;

- d) Ensure that the amusement ride is operated at all times in accordance with the operational procedures;
- e) Keep and maintain an operational log book which shall be updated daily, containing the following information concerning the operation of the amusement ride:
  - i) The dates on which the amusement ride is in operation;
  - ii) The names and duties of the persons engaged in the operation of the amusement ride;
  - iii) The operating hours of the amusement ride;
  - iv) The inspections that are carried on the amusement ride in accordance with the recommendation of the designer or manufacturer of the amusement ride;
  - v) Details of every inspection of the amusement ride carried out
  - vi) Details of any adverse incident occurring in respect of the amusement ride and the measures taken for the purposes of addressing such adverse incident;
  - vii) Details of any practice carried out for the taking of measures to address any occurrence of an adverse incident in respect of the amusement ride;
  - viii) A system for counter-signing of all records
- f) Keep and maintain a maintenance log book which shall contain a record of —
  - i) The periodic inspections of, and the carrying out of any maintenance work on, the amusement ride; and
  - ii) The servicing, repair or replacement of any component of the amusement ride (including a statement of the condition of such component); and
  - iii) A report of any test carried out on any component of the amusement ride.
  - iv) A system for counter-signing for all records
- g) Take all reasonable measures and precautions to ensure that any patron using the amusement ride does not take with him or on his person any item that is likely to

endanger the safe operation of the amusement ride or the safety of other patrons using the amusement ride;

- h) Take all reasonable measures and precautions to ensure that the following persons are not allowed to use the amusement ride:
  - i) Any person who appears to be under the influence of alcohol, drugs or any intoxicating substance;
  - ii) Any person who appears to be suffering from a contagious disease;
  - iii) Any person who appears to be suffering from any physical or mental condition and whose presence on the amusement ride is likely to prejudice the safety of that person or the safety of other patrons using the amusement ride; and
  - iv) Any person who is prohibited from using the amusement ride by the local authority
- i) Keep and maintain a written schedule for the periodic maintenance of all parts of the amusement ride, stating the intervals between inspections, lubrication, adjustments, replacements and any other works as recommended or required by the designer or manufacturer of the amusement ride, by any inspection body appointed to assess the safety of the amusement rides. (Refer to Example 5.4)
- j) Ensure that the periodic maintenance of the amusement ride is carried out with a written schedule for the carrying out of such periodic maintenance, stating the intervals between each occasion on which the components of the amusement ride are to be inspected, lubricated, adjusted or replaced, or on which any other work is to be carried out on the amusement ride in connection with such periodic maintenance.

EXAMPLE 5.4		
Recommended maintenance of the parts of the amusement ride		
Components	Maintenance actions	Frequency for action
Wire-rope	Lubricate with grease	Every 3 weeks
Carbon brushes of motor	Replace	Every 300 hours of operation
Checking alignment of limit switches and activation plate	Check and adjust when necessary	Every month

### 5.5.1 Selection of Ride Managers

The appointed ride manager should have either one of the attributes listed below: (Refer to Example 5.5)

*(Referred from the Amusement Rides Safety Regulations 2011)*

- i) Holds a university degree in any technical field and has at least one year of relevant practical experience; or
- ii) Holds a diploma or certificate in any technical field and has at least three years of relevant practical experience; or
- iii) Holds such other qualification or has such period of practical experience which, in the opinion of the local authority, is substantially equivalent to any qualification or relevant practical experience referred to in sub-paragraph (a) or (b); or
- iv) Has such knowledge and practical experience as the local authority may determine to be sufficient for the person to be able to competently carry out the duties of a ride manager.

“Technical field” refers to engineering knowledge that will be relevant to the design and maintenance process of amusement rides.

“Relevant practical experience” refers to practical experience in the management or supervision of the operation or maintenance of amusement rides

### EXAMPLE 5.5

#### Attributes for a Ride Manager's Role

Attribute	Example
a	<ul style="list-style-type: none"><li>• Degree in any Technical Field</li><li>• 1 year experience of being in the maintenance or operation of an amusement ride.</li></ul>
b	<ul style="list-style-type: none"><li>• Diploma in any Technical Field</li><li>• 3 years' experience of being in the maintenance or operations of an amusement ride.</li></ul>
c	<ul style="list-style-type: none"><li>• Situation when the personnel does not have any degree, diploma<ul style="list-style-type: none"><li>- Certification from National Association of Amusement Ride Safety Organisation or the Amusement Industry of Manufacturers and Suppliers Trade Association</li></ul></li></ul> <p>Or</p> <ul style="list-style-type: none"><li>- 5 years of experience in the maintenance or operation of an amusement ride</li></ul>

### 5.6 Training Records

The training records of individual staff should be kept throughout his/her employment period with the organisation. All trainings administered to a staff when completed shall be indicated in the records initiated with the signature of the trainer or the immediate supervisor.

### EXAMPLE 5.6

#### Employee's Training Record

**Name of Employee**

Job Title

Supervisor

Date employment  
commenced

Date employment  
ended

	Date training due	Training carried out and by whom	Employee confirmation
New Staff Training including Induction			
Supervisory Training (if appropriate)			
Retraining			
Refresher Training			
Vocational and Formal Training Training appropriate to duties i.e. low risk, high risk or manager/supervisor.			
Other Training (eg. First Aid)			

Records of training and copies of training certificates are recommended to be kept for the duration of employment.

## 5.7 Training Needs Analysis

A method to assess the competency level of all staff should be developed by the organisation. Staff with low competency should be identified and supervised closely so as to ensure the quality of the maintenance and repair work and the safety during operation.

Training plan for individual staff should also be developed to improve the competency of the individual staff progressively. The immediate supervisor should regularly assess the competency of individual staff and plan the necessary action such as on-the-job-training and training course by manufacturers or external training agency to improve the competency level of the staff. (Refer to Example 5.7 and 5.8)

<b>EXAMPLE 5.7</b>		
<b>Staff Competency Levels</b>		
<b>Competency Descriptors</b>	<b>Competency Levels</b>	<b>Definitions</b>
Entry	1	<ul style="list-style-type: none"><li>• Does not have any knowledge in the ride component.</li><li>• Requires close supervision in maintenance and repair of ride component.</li></ul>
Intermediate	2	<ul style="list-style-type: none"><li>• Familiar with ride component.</li><li>• Requires little supervision in maintenance and repair of ride component.</li></ul>
Advanced	3	<ul style="list-style-type: none"><li>• Able to work independently in maintenance and repair of ride component.</li></ul>
Proficient	4	<ul style="list-style-type: none"><li>• Able to supervise junior staff in maintenance and repair of ride component.</li></ul>

### EXAMPLE 5.8

#### Training Needs Analysis

Ride Component	Current competency level	Required competency level to be achieved	Suggested actions to achieve required competency level
Hydraulics	1	2	To be attached to level 4 technician for on-the-job –training.
Control system	2	3	Attend a PLC course
Drive system	3	4	Attend courses by drive manufacturer.
Ride structure	2	3	Attend welding course



## 6 Incident Reporting and Investigation

### 6.1 General

The organisation shall have a proper guideline on the categorisation of ride incidents in terms of severity that have occurred on the rides. The categorisation of the ride incidents will determine the procedures for reporting of the incident within and outside of the organisation and the follow-up actions required by the organisation. Procedure for proper investigation after the incident shall also be set up by the organisation to determine the cause of the incident and the follow-up actions to prevent similar future occurrence of the incident. The procedure for incident reporting and investigation shall meet the requirement of the local authorities.

### 6.2 Category of incidents

The ride incidents may be classified as followed (Refer to Example 6.1):

#### EXAMPLE 6.1

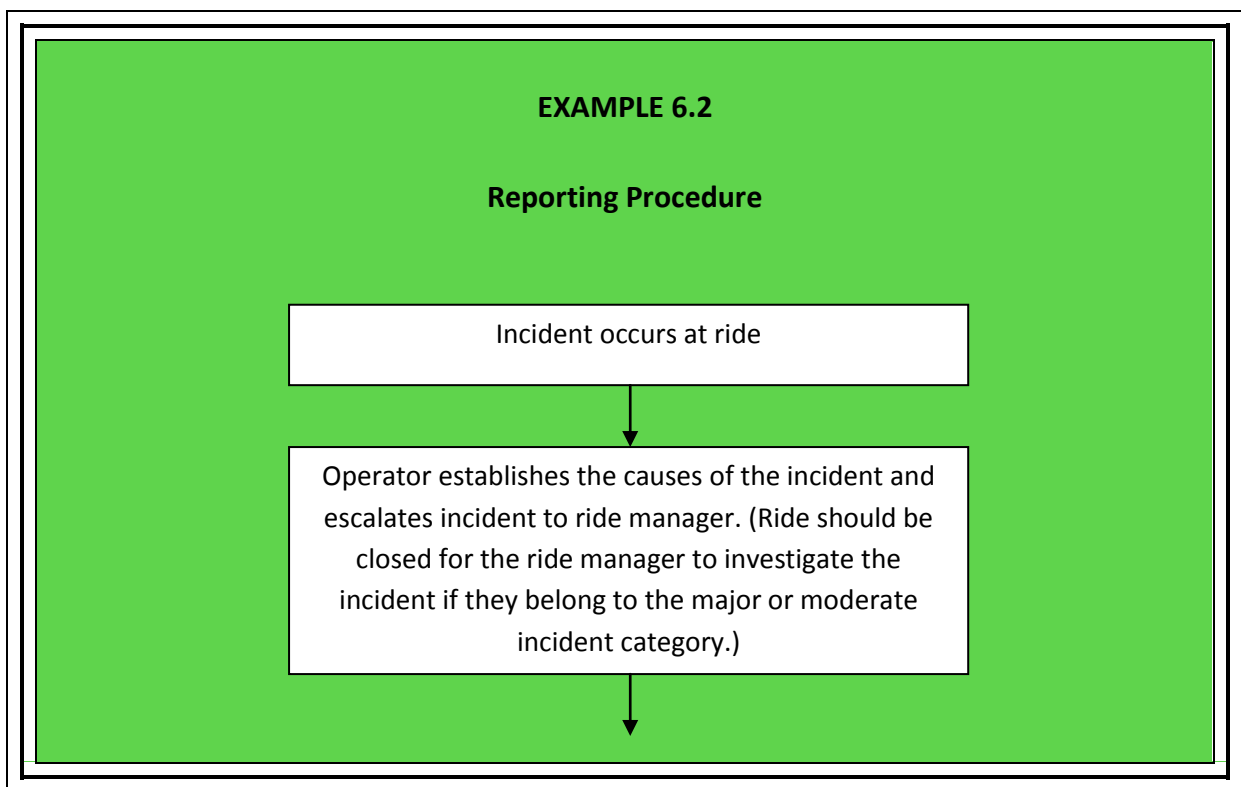
##### Categorisation of Ride Incidents

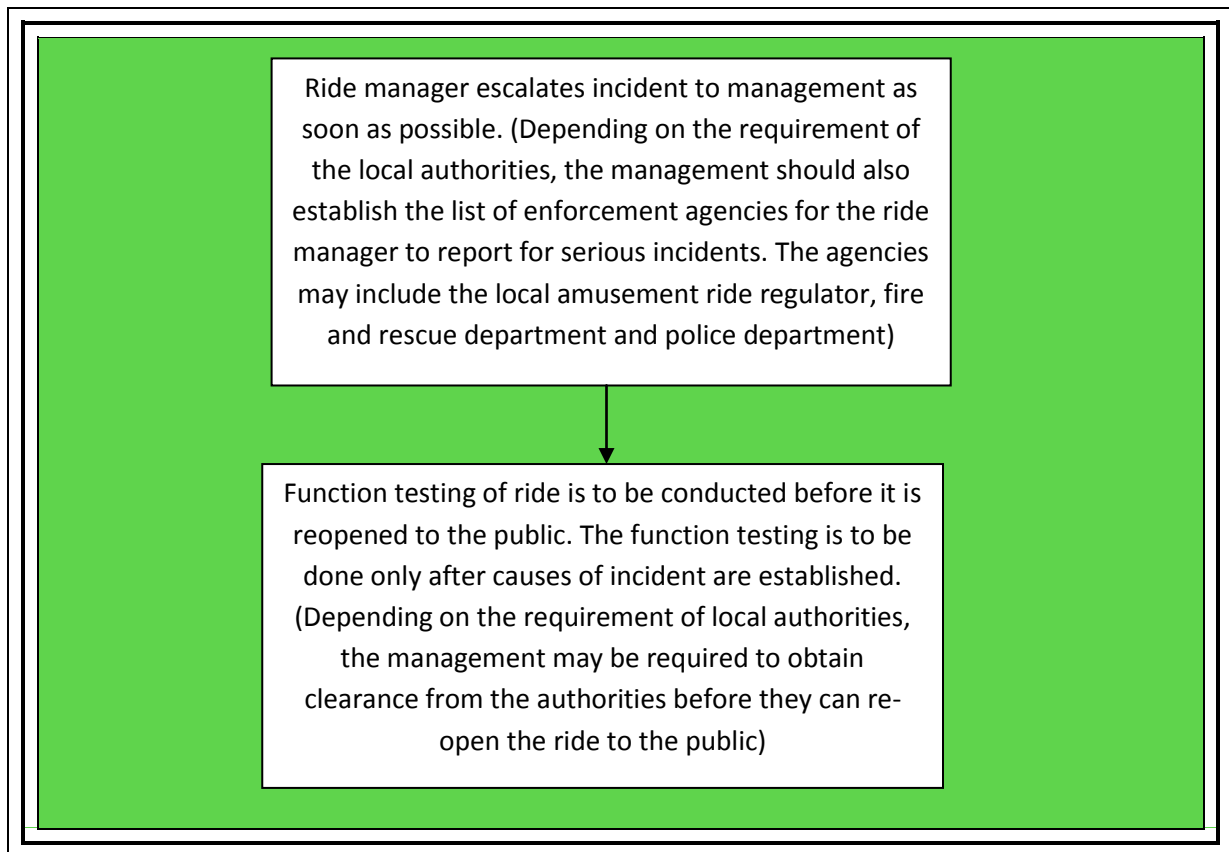
Category	Type of incidents
Major	<ul style="list-style-type: none"><li>• Death involving patrons or staff during operation of ride.</li><li>• Serious injuries of patrons or staff occurring during operation of ride which require hospitalisation or treatment by medical professional</li><li>• Evacuation of patrons using height rescue equipment such as boom lifts or rappelling</li><li>• Serious mechanical or electrical component failures of rides during operation i.e. wire-ropes, restraint, track derailment , drive system and control system</li><li>• Serious structural failures such as track i.e. cracks in welds of load bearing parts</li></ul>
Moderate	<ul style="list-style-type: none"><li>• Minor injuries of patrons or staff occurring during operation of ride which require first aid treatment</li><li>• Unintended ride stoppage with patrons on board the ride of more than 10 mins. This stoppage can be due to inclement weather, equipment malfunction or any other factor.</li></ul>

Minor	<ul style="list-style-type: none"> <li>• Evacuation of patrons from the ride via path provided for evacuation access.</li> <li>• Other ride related incident which are not listed in the first 2 categories such as vomiting or nausea experienced by the patron or Loss of electrical power to the facility</li> </ul>

### 6.3 Internal/External Reporting

A possible reporting procedure format may be as follows (refer to Example 6.2):





#### **6.4 Purpose of investigation**

The purpose of an investigation into a ride incident should consist of the following:

- a) To determine underlying cause;
- b) To prevent similar incidents;
- c) To take action against liable parties; and
- d) To assist local authorities in their investigation

#### **6.5 Investigation procedures**

A typical investigation procedure should include the following:

- a) Interviews of patrons, operators, maintenance crew;
- b) Reviews of operation and maintenance records;

- c) Equipment testing or checking; and
- d) Establish the root cause of the incident.

The investigation should not be limited to identification of component(s) failures, non-compliances by staff and patron behaviour. Factors such as environmental factors or any other types of circumstantial reasons should also be considered. A formal report shall be produced to document the findings of the investigation for all categories of incidents.

For major or moderate incident, an in-depth investigation should be conducted. If necessary, the incident should be investigated by a 3<sup>rd</sup> party professional who has expertise in the investigation of amusement ride incidents.

## **6.6 Closing on investigation findings**

Once the causes of an incident are determined, the organisation and the ride manager shall propose measures to prevent future similar incident from occurring. For a major or moderate incident, the organisation and the ride manager should discuss with the 3<sup>rd</sup> party technical expert involved in the investigation to determine the measures to be implemented.

Short term measures should focus on the corrective measures that need to be implemented immediately to prevent recurrence while long term measures shall seek to improve the overall safety system of the ride.

A review of the organisation risk assessment document should also be carried out to mitigate any risk that is unforeseen or not adequately mitigated before the incident.

These proposed measures and the review of the risk assessment with its dates of implementation and review shall be documented for future reference.

## **6.7 Analysis of incident information**

The organisation shall maintain a record of all incident occurrences for the amusement ride. The record shall at least contain the following data or info: (Refer to Example 6.3)

- a) Type of incident
- b) Details of incident, such as date and time of incident and description of the incident

- c) Details of personnel involved in an incident, such as age and gender of patrons involved in incident, and details of injuries, if any
- d) Details of operator operating or supervising the operation the ride i.e name and number of hours on duty before the incident occurred, experience of the operator with regard to the operation of the ride, and training given to the operator.
- e) Location of incident
- f) Cause of incident
- g) Incident frequency rate – defined as numbers of incidents per man-hours worked
- h) Incident severity rate – defined as the number of man days lost per man hours worked
- i) Mitigating measures implemented after the incident, and tracking of incident statistics after the implementation to determine its efficiency

The record shall be analysed at a regular interval by the organisation for observation of any pattern associated with the incidents. The causes for the pattern shall be determined, and measures proposed by the organisation and the ride manager to prevent similar incidents from occurring in the future. These processes should be documented after completion and made available to all staff and maintained for future reference.

### EXAMPLE 6.3

#### Incident Information

Location of incident	Type of incident	Cause of incident	Date and time of incident	Mitigating measures
Section 2 and 3 of water slide	Patron suffered abrasion on arms	Silicon gel of joints between section 2 and 3 wear off	22 June 2011 1300hrs	Re-applying of silicon gels between parts on joints
Splash area	Patrons suffer bruises on head	Collision between two patrons due to the insufficient time intervals between 2 dispatch timings ( miscommunication between dispatcher and lifeguard )	16 Aug 2012 1100hrs	Dispatcher and lifeguard have been given verbal warning and given re-training on procedures.

## **7 Emergency Response and Programmes**

### **7.1 General**

Emergency response should focus on the prevention of ill health and injury, and on the minimisation of the adverse safety consequences to a person(s) exposed to an emergency situation. The organisation should assess the potential for emergency situations that may impact amusement ride safety and develop procedures for effective responses. The organisation should periodically test its emergency preparedness and seek to improve the effectiveness of its response activities and procedures to ensure that all reasonably possible emergency situations have been planned and prepared for.

The Emergency Response Programme should consist of the following 6 components:

- a) Identification of potential emergency situations;
- b) Establishing and implementing emergency response procedures;
- c) Emergency response equipment;
- d) Emergency response training;
- e) Periodic testing of emergency procedures; and
- f) Reviewing and revising emergency procedures

### **7.2 Identification of potential emergency situations**

Procedures to identify potential emergency situations that could impact amusement ride safety should consider emergencies that can be associated with specific activities, equipment, locations or people.

Examples of possible emergencies, which vary in scale, include:

- a) Incidents leading to death, serious injuries or ill health;
- b) Fires and explosions;
- c) Failure of critical equipment;
- d) Failure of any structure or component of the ride;

- e) Evacuation using reach equipment or abseiling;
- f) Derailment;
- g) Collision;
- h) Loss of utility supply (e.g. loss of electric power);
- i) Release of hazardous materials / gases;
- j) Natural disasters or bad weather that cause ride stoppage;
- k) Pandemics / epidemics / outbreaks of communicable disease; and
- l) Civil disturbance, terrorism, sabotage, workplace violence

Information that should be considered in identifying potential emergency situations includes the following:

- a) The results of hazard identification and risk assessment activities performed
- b) Legal requirements;
- c) The organisation's previous incident and emergency experience;
- d) Emergency situations that have occurred in similar organisation; and
- e) Information related to incident investigations posted on the websites of regulators or emergency response agencies.

### **7.2.1 Specific activities**

When identifying potential emergency situations, consideration should be given to emergencies that can occur during both normal operations and abnormal conditions (e.g. operation start-up or shut-down, installation and modification works, testing and inspections, maintenance and evacuation).



### **7.2.2 Equipment**

The types of equipment that could pose hazards to its users are hazardous materials and safety critical equipment whereby their failure could cause injury to patrons or staff. Hazardous materials include such as gasoline or dry ice, hazardous gases such as chlorine used in water based rides, flame effects or pyrotechnics devices that could be used near patrons during a show as part of the ride. Safety critical equipment failure such as structural failure or failure of safety devices may lead to emergency situations.

### **7.2.3 Locations**

Consideration should be given to the types of location where the amusement ride is located, such as whether it is in the outdoors and subjected to inclement weather conditions, or whether it is located in a confined space where hazardous material is placed. Below are examples of some locations where the rides may be located and the necessary actions which should be taken to reduce the risks that may arise due to the conditions of the locations: (refer to Example 7.1)

### EXAMPLE 7.1

#### Considerations on a Location for an Amusement Ride



**Scenario:** Rollercoaster that is installed near/over a lake or deep water area

**Condition of location:** No fences segregating the lake or deep water areas from the roller coaster installation.

**Measures to be taken to minimise the risks:**

Emergency measures should be planned for certain scenarios. For example, in this case, a possible scenario would be a situation where patrons happen fall into the lake or water body. A possible emergency measure would then be to evacuate patrons by the means of rope access for certain inaccessible areas of the water body. For such an emergency measure to be effective, a trained team of rope access personnel should have been arranged to be on standby and regular drills be conducted for familiarisation. The access route for the emergency vehicle would also have to be worked out.

#### 7.2.4 People

Various categories of people could cause emergency situations, for example untrained or negligent staff, unruly or violent patrons, or simply people who managed to gain access to an area which is supposed to be out of bounds to unauthorised personnel. The organisation should determine and assess how emergency situations will impact all persons within and/or in the immediate vicinity, and all parties involved in the emergency response, e.g. patrons, staff, emergency services and neighbours.

### **7.2.5 People with special needs**

Consideration should be given to those with special needs, e.g. people with limited mobility, vision and hearing. This could include patrons, employees, temporary workers, contract employees, visitors or other members of the public. Special equipment, directions and staff training may be required in order to rescue and evacuate these people in an emergency situation.

### **7.3 Establishing and implementing emergency response procedures**

Emergency response plan should consist of the following: (Refer to Example 7.2)

- a) Identification of potential emergency situations and locations;
- b) Responsibilities and authorities of personnel with specific response duties and roles during the emergency (e.g. fire-wardens, first-aid staff and spill clean-up specialists);
- c) Details of the actions to be taken by personnel during the emergency (including actions to be taken by staff working off-site, by contractors and visitors);
- d) Evacuation procedure;
- e) Interface and communication with emergency services;
- f) Communications with public, patrons, employees (both on-site and off-site), regulators and other interested parties (e.g. family, neighbours, local community, media);
- g) Information necessary for undertaking the emergency response (plant layout drawings, identification and location of emergency response equipment, identification and location of hazardous materials, utility shut-off locations, contact information for emergency response providers).

### EXAMPLE 7.2

#### Responsibilities of Personnel with Response Duties

Personnel	Duties and Responsibilities
Ride Manager	<ul style="list-style-type: none"><li>- Notify the authorities of the date and time of incident, number of casualties and their extent of injuries</li><li>- Immediately cease operations of the ride and coordinate with the ground staff and maintenance personnel to help evacuate patrons from the ride vehicles and facility</li><li>- Setup a command post for relevant authorities (BCA and SCDF in Singapore) where meetings, discussions on the rescue and coordination efforts could take place</li><li>- Setup up a First Aid Centre where the injured patrons could be evacuated and attended to by medical personnel</li><li>- Liaise and coordinate efforts to help establish the causes for the incident and secure evidence for investigative work purposes.</li><li>- Evaluate the causes and provide a RA to help mitigate the risks and probability of occurrence through a comprehensive review of both operations and maintenance SOPs</li></ul>
Operations/Maintenance Manager	<ul style="list-style-type: none"><li>- Assist the Ride Manager/Supervisor in stopping the ride and provide the manpower to assist operations in evacuating the patrons from the ride vehicles and facility building</li><li>- Provide technical assistance for rescue and evacuation processes.</li><li>- Provide technical expertise to help establish the root causes of incident.</li></ul>

Consideration should be given to the existence and/or capability of the following, in developing emergency response plan and procedures:

- a) People
  - i) Numbers of people in the various locations
  - ii) Whether there are any people with special needs
- b) Equipment that can cause hazardous situations
  - i) Critical systems that can impact on amusement ride safety
  - ii) Inventory and location of hazardous materials storage
  - iii) Monitoring systems for hazardous materials
- c) Equipment for emergency response
  - i) Detection and emergency control measures
  - ii) Fire detection and suppression systems
  - iii) Control systems, and any supporting secondary or parallel / multiple control systems
  - iv) Emergency power sources
  - v) Medical equipment, first aid kits, etc
- d) Emergency response
  - i) The provision of emergency training
  - ii) Availability of local emergency services and details of any emergency response arrangements currently in place
  - iii) Previous emergency response experience

Some emergency situations can be inter-related and require a holistic approach in the response which may involve a combination of a few emergency response procedures, such as a fire situation can also lead to loss of power supply of the amusement ride. Where the procedure is combined with other emergency response procedures, the organisation needs to ensure that it addresses all potential impact on amusement ride safety and should not presume that the procedures relating to each situation such as fire safety, or environmental emergencies, etc., will be sufficient. (Refer to Example 7.3)

### EXAMPLE 7.3

#### Emergency Response to Situations

Situations	Emergency Responses
Power Failure	<ul style="list-style-type: none"><li>- Operations to stop the ride, suspend operations.</li><li>- Checks are to be conducted by the maintenance team on all control and electrical subsystems</li><li>- Start evacuation process and switch to a backup system if main power system is not able to resume default status within 30 mins</li><li>- Evacuate the patrons from the ride vehicles and facility in an orderly and systematic manner</li><li>- In the event if any patrons are stranded on an elevated level, ensure all ride vehicles are secure and locked and work with authorities in charge of the rescue and evacuation processes.</li><li>- Establish the root causes and findings of the power failure along with the corrective measures proposed in a summary report, which is to be forwarded to both Ride Manager and relevant authorities.</li></ul>
System or Device Failure	<ul style="list-style-type: none"><li>- Operations to stop the ride, suspend operations and inform relevant authorities.</li><li>- Maintenance team will try to clear the device/faults alarms by either resetting them or switching to a fall back system</li><li>- Start evacuation process if the faults are not normalize or system is not able to resume default status within 10 mins</li><li>- Evacuate the patrons from the ride vehicles and facility in an orderly and systematic manner</li><li>- In the event if any patrons are stranded on an elevated level, ensure all ride vehicles are secure and locked before commencing on the evacuation process</li><li>- Establish the root causes and findings of the system or device failures along with the mitigations and corrective measures proposed in a summary report, which is to be forwarded to both appropriate authorities.</li></ul>

The emergency procedures should be clear and concise to facilitate their use in emergency situations. They should also be readily available for use by emergency services. Emergency procedures that are stored on a computer or by other electronic means might not be readily available in the event of a power failure, therefore paper copies of emergency procedures ought to be maintained in readily accessible locations.

When the organisation determines that external services are needed for emergency response (e.g. specialist experts in handling hazardous materials), prior arrangement with the qualified service providers should be in place. Particular attention should be paid to staffing levels, response schedules and emergency service limitations.

Emergency response procedures should define the roles, responsibilities and authorities of those with emergency response duties, especially those with an assigned duty to provide an immediate response, such as the Company Emergency Response Team (CERT). These personnel should be involved in the development of the emergency procedures to ensure they are fully aware of the type and scope of emergencies that they can be expected to handle, as well as the arrangements needed for coordination. Emergency service personnel should be provided with the information required to facilitate their involvement in response activities.

#### **7.4 Emergency response equipment**

The organisation should determine and review its emergency response equipment and material needs.

Emergency response equipment and materials can be needed to perform a variety of functions during an emergency, such as evacuation (refer to Example 7.4), leak detection, fire suppression, chemical / biological / radiological monitoring, communication, isolation, containment, shelter, personal protection, decontamination, and medical evaluation and treatment.

Emergency response equipment should be available in sufficient quantity and stored in locations where it is readily accessible; it should be stored securely and be protected against damage. This equipment should be inspected and/or tested at regular intervals to ensure that it will be operational in an emergency situation.

Special attention should be paid to equipment and materials used to protect emergency response personnel. Individuals should be informed of the limitations of personal protective devices and trained in their proper use.

The type, quantity and storage locations for emergency equipment and supplies should be evaluated as a part of the review and testing of emergency procedures.

<p><b>EXAMPLE 7.4</b></p> <p><b>Emergency Equipment for Evacuation</b></p>	
Scenario	Emergency Equipment
Loss of power from main electrical source	Power Generator (E.g Diesel Engines)
Failure of Main Electrical Drive	Secondary Electrical Drive
Failure of Mechanical Component (e.g coupling, gearbox, shaft linking to ride vehicle)	Emergency equipment to transport ride vehicle to unloading point (e.g Emergency Engine to run the Bullwheel for Cable Cars)

### 7.5 Emergency response training (ERP)

Personnel should be trained in how to initiate the emergency response and evacuation procedures.

The organisation should determine the training needed for personnel who are assigned emergency response duties and ensure that this training is received. Emergency response personnel should remain competent and available on site or on short notice and capable to carry out their assigned activities.

The need for retraining or other communications should be determined when modifications are made that impact on the emergency response. Non-ERP personnel should also be briefed on how to coordinate with the Emergency Response team and other external parties



## **7.6 Periodic testing of emergency procedures**

The organisation should also periodically test its procedures to respond to emergency situations, where practicable, by conducting table-top exercises on handling worst credible scenarios, tests, drills or exercises involving relevant interested parties as appropriate.

Periodic testing of emergency procedures should be performed to ensure that the organisation and external emergency services can appropriately respond to emergency situations and prevent or mitigate safety consequences.

Testing of emergency procedures should involve external emergency services providers, where appropriate, to develop an effective working relationship. This can improve communication and cooperation during an emergency.

Emergency drills can be used to evaluate the organisation's emergency procedures, equipment and training, as well as increase overall awareness of emergency response protocols, internal parties (e.g. workers) and external parties (e.g. fire department personnel) can be included in the drills to increase awareness and understanding of emergency response procedures.

The organisation should maintain records of emergency drills. The type of information that should be recorded includes a description of the situation and scope of the drill, a timeline of events and actions and observations of any significant achievements or problems. This information should be reviewed with the drill planners and participants to share feedback and recommendations for improvement.

## **7.7 Reviewing and revising emergency procedures**

The organisation should periodically review and, where necessary, revise its emergency preparedness and response procedures, in particular, after periodical testing and after the occurrence of emergency situations (see Section on Incident Reporting and Investigation).

Emergency planning should also be reviewed as a part of the on-going management of change. Changes in operations can introduce new potential emergencies or necessitate that changes be made to emergency response procedures. For example, changes in facility layout can impact emergency evacuation routes.

Review of the emergency preparedness and response procedure(s) should be done periodically to ensure that they are current and relevant. Examples of when this can be done are:

- a) On a schedule defined by the organisation;
- b) During management reviews;

- c) Following organisational changes;
- d) As a result of management of change, corrective action, or preventive action;
- e) Following an event that activated the emergency response procedures;
- f) Following drills or tests that identified deficiencies in the emergency response;
- g) Following changes to legal and other requirements;
- h) Following external changes impacting the emergency response;

When changes are made in emergency preparedness and response procedure(s), these changes should be communicated to the personnel and functions that are impacted by the change; their associated training needs should also be evaluated.

## **7.8 First Aid**

Adequate first aid shall be available at all times when the amusement ride is in operation. For good practice, adequate first aid should also be available during installation, modification, testing and maintenance of the amusement ride.

### **EXAMPLE 7.5**

#### **Contents for a First-Aid Kit**

The following list sets forth the minimally acceptable number and type of first-aid supplies for first-aid kits required for the logging standard. The contents of the first-aid kit listed should be adequate for small rides, consisting of approximately two to three employees. Where larger rides are being conducted at the same location, additional first-aid kits should be provided around the ride vicinity or additional quantities of supplies should be included in the first-aid kits:

- Gauze pads (at least 4 X 4 inches).
- Two large gauze pads (at least 8 X 10 inches).
- Box adhesive bandages (band-aids).

- One package gauze roller bandage at least 2 inches wide.
- Two triangular bandages.
- Wound cleaning agent such as sealed moistened towelettes.
- Scissors.
- At least one blanket.
- Tweezers.
- Adhesive tape.
- Latex gloves.
- Resuscitation equipment such as resuscitation bag, airway, or pocket mask.
- Two elastic wraps.
- Splint.
- Directions for requesting emergency assistance.

The organisation shall ensure that the first aid boxes are in a serviceable and sanitary condition, and regular checks should be done to ensure none of the contents have expired, and timely replacement of used or expired items is done.

There shall also be sufficient numbers of first-aiders in attendance to render first aid when the necessity arises. These persons should be properly trained by a first-aid training organisation and their training records and certifications shall be kept current.

## **8 Patron Management**

### **8.1 General**

Patron management is the comprehensive system to manage the patron's behavior and experience for the amusement ride, and it can begin from the first touch point at the ticketing entrance of the ride/park until even after the patron has left the vicinity of the ride/park.

The 4 most direct aspects of patron management for safe usage of the ride are:

- a) Criteria for Ridership
- b) Queue Management
- c) Forewarnings (signage and verbal instructions)
- d) Behaviour Spotting
- e) Intervention

### **8.2 Criteria for Ridership**

The amusement ride is designed to support and contain the patrons during operation. In order to ensure ride safety, the loading limits should not be exceeded, and patron reach envelope, patron containment and restraint requirements should be strictly followed so that the ride can be operated as intended.

Ride operators should be given guidelines (Refer to example 8.2) on the special considerations concerning patron anthropomorphic factors (for example physical height, weight or age limits), rules for taking the ride (for example the prohibition of loose personal possessions or wearing of loose clothing) and the special considerations applicable to physically disabled and mentally impaired patrons, related to their particular ride or device. This information can usually be found in the manufacturer's manuals. If in doubt, always consult the manufacturer on the criteria for ridership. If necessary, tools should be provided to determine the criteria for ridership, for example a test seat with instructions to check for suitability (Refer to Example 8.1) or a height chart to determine the height of the patrons if there is a height limit for the ride.

### EXAMPLE 8.1

#### Test Seat for Checks on Suitability



Picture taken from [www.thecoastercritic.com](http://www.thecoastercritic.com)

Where it is foreseeable that certain passengers, by virtue of their physical characteristics (for example age, height, weight, hair length, clothing, medical condition, suspected state of intoxication ) or otherwise, may be at risk on certain passenger carrying amusement devices, they shall not be allowed to ride, unless sufficient additional protection can be given to them.

## EXAMPLE 8.2

### Criteria for Ridership

Criteria for ridership, if any, are indicated in the manufacturer's manual. Typical examples are:

Height restrictions:

- Patron above 2.0m are not allowed to ride (may exceed the patron reach envelop or height)
- Patron below 1.2m are not allowed to ride
- Patron above 1.2m but below 1.4m must be accompanied by a ride companion who is above 1.4m (or adult)

Weight limits:

- Maximum weight of patron allowable on the ride is 80 Kg

Age limits:

- Patron above 12 years old are not allowed to ride (for kiddy rides)
- Patron below 4 years old are not allowed to ride
- Patron above 4 years old but below 8 years old must be accompanied by a ride companion who is above 12 years old (or adult)

Other restrictions:

- Patron who cannot be properly secured by the restraint are not allowed to ride
- Patron who are pregnant are not allowed to ride
- Patron who are intoxicated or on drugs are not allowed to ride

### Example of rules for taking the ride

- Riders must remove all loose articles like spectacles, mobile phones, cameras, slippers, hat, etc before boarding the ride.
- Riders with long hair or loose clothing (e.g. a scarf) must tie up their hair or loose clothing before boarding the ride.
- Riders must remain seated and keep their hands and feet within the ride vehicle at all times during the ride.

- Each rider must be seated on a seat. Children are not allowed to sit on the lap of the accompanying ride companion (adult).
- Riders are required to remove any sharp objects including watches, rings, etc before boarding the ride (e.g. for water walking balls and inflatables)
- Only one rider is allowed on the slide at any time (e.g. for water slide)
- Riders are not allowed to race with other riders (e.g. for go-kart and bumper cars)

**Example of special consideration for taking the ride**

- Patrons using artificial legs or do not have both legs are not allowed to take this ride (e.g. the ride is using a lap bar that secures the patron to the seat. If the patron do not have both legs, the lap bar is not effective to hold the patron during the ride.)

### **8.3 Queue Management**

Queue lines smoothly direct patrons in an orderly manner to the ride loading area so that loading can be done safely. Without proper queue management, the situation at the loading area may become rowdy and out of control, thereby jeopardizing safety of the patrons. It is a good practice to have proper securing gates or latches to segregate the loading patrons or patrons on the ride from the next batch of patrons waiting at the queue line to be loaded.

Proper and clear procedures for the job of the personnel manning the queue line, gate and the loading area should be provided. This should include the criteria for ridership and behavior spotting. (Refer to Example 8.3)

## EXAMPLE 8.3

### Duties of Queue Personnel

#### Duties of Queue Personnel

##### Environment check:

1. Ensure that the queue lines are in place and orderly.
2. Ensure that the queue lines and surrounding areas are free of debris and obstacles.

##### Patrons check:

3. Greet patrons cheerfully.
4. Explain the requirements for the ride:
  - a. Height requirement of 1.2m and above
  - b. High acceleration ride
  - c. If suspected to have health problems such as heart, respiratory, back or spinal problems, should not take the ride
  - d. Loose clothing are not allowed on the ride
5. If the following patrons are spotted, firmly and politely explain to them the ride's requirements and request them to step out of the queue:
  - a. Patrons less than 1.2m in height (to verify using height measuring stick if required)
  - b. Suspected intoxicated patrons (indications are: slurry speech, unable to move in a coordinated manner, smell of alcohol)
  - c. Patrons with long flowing clothing and scarves
6. Request all baggage and loose objects to be placed at the side before loading onto the ride.



## **8.4 Behaviour Spotting**

### **8.4.1 Acceptable and unacceptable behaviour**

The operator should determine the kinds of acceptable and unacceptable behaviour throughout the ride, from the queue line until the patron exits the ride and its vicinity. If a patron adopts unacceptable behavior, the operator should have the authority to deny entry to the ride to that patron or stop the ride. This is because some behaviour (for example reckless behavior or disregarding clear and reasonable instructions) may cause above normal exposure to risk of discomfort or injury to the patron, or may jeopardize the safety of other patrons or employees.

### **8.4.2 Spotting of unacceptable behaviour**

Ride personnel should be briefed and trained to spot such unacceptable behaviour and manage them as soon as possible. They should also be positioned in a spot where they can survey the entire queue line and loading area. In the event that this is not possible, CCTV cameras or other visual aids, or additional personnel may be required, depending on the risk assessment.

### **8.4.3 Training of operators for intervention**

Once unacceptable behaviour is spotted, the operator should intervene and take remedial actions as soon as practicable to correct it or to prevent the patron from causing any harm. Operators should be trained in how they should intervene to protect all parties involved. The intervention should not be done in such a way that would elicit unfavourable reaction from the patron or cause any harm to them.

## **8.5 Forewarnings (Signage and Verbal Instructions)**

Forewarnings in the form of visual signage together with verbal instructions are important in ensuring that the criteria for ridership is made known to the patrons and that the patrons know how they should behave when in the vicinity of the ride and when taking the ride. Requirements and information for signage should be provided by the manufacturer as well as amusement ride standards and codes. Furthermore information on what to expect from the ride, in terms of its risk and impact, should be made known to the patron in advance. The operator of an amusement ride shall display prominently at all times at the entrance to the amusement ride, a notice stating the following information concerning the amusement ride: (Refer to Example 8.4 and 8.5)

- a) Any structural, electrical, mechanical or physical dangers of the amusement ride;
- b) The maximum number of patrons permitted to be carried on the amusement ride during each ride;
- c) The items that a patron is prohibited from carrying with him or on his person during his use of the amusement ride;
- d) The class of persons for whom it would be unsafe to use the amusement ride (for example, patrons who are above a specified weight, who are above or below a specified height or who suffer from any physical or mental condition as would render it unsuitable for them to use the amusement ride);
- e) The safety equipment that must be worn or used by patrons during their use of the amusement ride;
- f) Whether it is necessary for a person of or above a specified age to accompany or attend to a child using the amusement ride; and
- g) Such other information as may be required by the designer or manufacturer of the amusement ride.

## EXAMPLE 8.4

### Amusement Ride Notice and Information

#### RIDE INFORMATION

<<NAME OF AMUSEMENT RIDE>>

<<DESCRIPTION OF THE AMUSEMENT RIDE>>

WARNING <<In another common language other than English>>

Persons with the following conditions should not ride: <<In another common language other than English>>



Arm or leg casts <<In another common language other than English>>



Heart conditions <<In another common language other than English>>



Blood pressure conditions <<In another common language other than English>>

#### ACCESSIBILITY

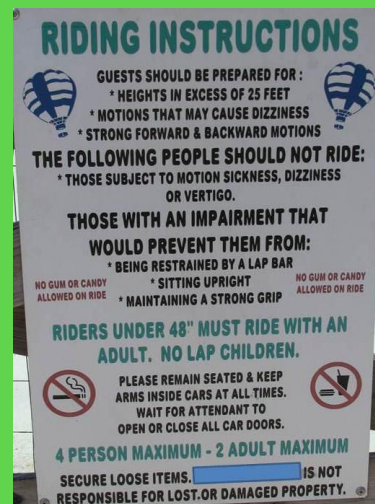


Guests under <<Restricted height>> in height may not ride <<In another common language other than English>>

Please check with attendant for assistance

## EXAMPLE 8.4

### Visual Signage





Besides visual signage, verbal instructions serve to further reinforce the requirements to take the ride – criteria for ridership and acceptable behavior while on the ride or in the vicinity of the ride. Clear verbal instructions are often found to be very effective reminders for the patrons, and should be used for all important safety related messages. (Refer to example 8.5)

For rides which require patrons to perform certain tasks while taking the ride, checks should be made prior to the start of the ride to ensure that the patrons have understood and could perform the required tasks adequately.

### **EXAMPLE 8.5**

#### **Verbal Instruction**

- a) Please keep your hands and feet within the ride vehicle at all times during the ride.
- b) Please remain seated and fasten your seat belts. Ensure that your seat belt is tight and the buckle is properly locked. Try and pull the seat belt to ensure that it is not too loose or come out of the buckle.
- c) The green pedal is for acceleration and the red pedal is for the brakes (for go-kart). Do not step on the green pedal until you are ready to go. Now, you can try to step on the red pedal to see if you can reach it.
- d) The heavier person should sit front and the lighter person should sit behind (e.g. water slide for 2 people in a ride vehicle)

## **8.6 Patron-Directed Rides**

Patron-directed rides enable the patrons themselves to have much control over the movement of the ride or the state of the ride, and therefore subject themselves to more risks. Patron behavior and condition would thus require closer scrutiny. For example, a patron may be required to perform certain tests satisfactorily before being allowed to use the ride. Declaration from the individual patrons should also be required to ensure that they have full knowledge of the risks involved and to check that they satisfy the criteria for ridership.

## 9 Communications

The objective of communications is to inform and formally address issues and take appropriate actions to achieve amusement rides safety management system objectives

### 9.1 Communication Procedures

The organisation should establish, implement and maintain a procedure(s) for:

- a) Internal communication among the various levels and functions of the organisation;
- b) Communication with patrons; (Refer to example 9.1)
- c) Receiving, documenting and responding to relevant communications from external parties such as ride manufacturers designers and authorities.

Consultation and communication with internal and external stakeholders include amusement rides matters that can affect safety such as changes in operations, processes, and procedures; decision on implementation of processes and procedures to manage risks, hazard identification, review of risk assessment and control etc.

#### EXAMPLE 9.1

##### Communication Brief to Patrons

DOC 15AX.1

JOLLY PARK AMUSEMENTS

COMMUNICATIONS WITH GUESTS IN THE EVENT OF RIDE DOWNTIME

##### Purpose

To assure timely and accurate public response in the event of an ride downtime >30 mins

##### Procedure

The ride supervisor shall be in charge in the event of a ride downtime involving Amazon Park

Rides. The preparations shall be developed by the Park Manager. The communications plan and any trainings of staff will be developed and managed by the Park Manager and the respective supervisors

#### **Roles and Responsibilities**

The following key personnel are identified and their roles and responsibilities are as follows:

<b>Key personnel</b>	<b>Roles and responsibilities</b>
Park Managers	As denoted in the Park Operating Procedures manual (Section 8, Public Communications)
Ride Supervisors	
Operators	

#### **Communication Channels**

In the event of a prolonged ride downtime >30 mins, all key personnel are to inform the following key stakeholders via the appropriate level of communication channels listed in the Park Operating Procedures manual (Section 17, Communication Channels)

### **9.2 Communication Platforms**

Consultation and communication processes may include small groups meetings that are established to promote communication and co-operation between management and employees to ensure that issues are addressed and appropriate actions taken.

It is one platform on which representatives from various departments and functions, as well as suppliers, work together on amusement rides safety matters. This is for the purpose of improving, promoting and reviewing all matters relating to amusement rides safety matters. It also acts as a channel for communicating and imparting knowledge and best practices on amusement rides to all personnel.

### **9.3 Communications System**

It is important that any announcement made pertaining to the ride reach patrons who are in the queue line. The operator of amusement rides shall put in place a communications system for the amusement ride and ensure that every person employed in the operation of



the amusement ride is properly trained on the use of the communications system, including the making of public announcements with the communications system.

#### **9.4 Meetings**

The operator of the amusement ride shall establish procedures to ensure that group meetings are conducted effectively and at regular intervals. The operator shall ensure that records of all such meetings are documented and maintained. The meeting shall address amusement rides safety matters on operational and maintenance issues. The meeting shall include the chairman and secretary and sufficient representatives from all relevant departments to ensure that all aspects of the amusement ride(s) are adequately covered. The minutes of the meetings shall be properly recorded and maintained. All decisions and follow-up actions shall be documented.

If there is any safety bulletin received from the ride manufacturer or designer, the operator shall submit the bulletin to the local authorities and as soon as is practicable, and implement any safety measure specified in the safety bulletin.

#### **9.5 Safety Committee**

A safety committee should also be formed to serve as one of the communication platforms where the members of all levels of the organisation can discuss on safety issues and improvements. It would also help the management to deliver safety information to the company employees as well as provide a channel for feedback and suggestions from the employees at all levels. The organisation should consider the following in setting up a safety committee.

- a) Selection of the committee members – Members should be all represented all levels of the organisation.
- b) Involvement of the Top Management – Top management involvement and support is essential to assure the employees of the company's commitment to safety.
- c) Frequency of the Committee Meetings.
- d) Review of the progress of the committee. – The safety committee's progress should be reviewed after a specific length of time in order to evaluate the committee's performance in helping the organisation meet its safety goals and objectives.

## **10 Documentation**

The organisation should establish and maintain information in a suitable medium such as paper or electronic form for up-to-date and adequate documentation to ensure effective operation of the amusement rides safety management system. The documentation should provide adequate information that describe the elements of the management system and their interactions, and provide direction to related documents.

The ride manager of the amusement ride should update and review the documents periodically.

### **10.1 Document Control**

The organisation should establish and maintain procedures for controlling all relevant documents and data. Such documents can include (but not limited to):

- a) Safety policy and organisation structure;
- b) Risk assessment register;
- c) Hazard identification and risk assessment records;
- d) Legal register;
- e) Licenses, certificates, permits from relevant government agencies and independent inspection bodies;
- f) Operations and maintenance manual,
- g) Operational safe work procedures, in-house safety rules and regulations;
- h) Engineering design drawings which includes foundation and structural drawings;
- i) Job descriptions of personnel in the organisation related to the amusement ride;
- j) Group meeting records and minutes;
- k) Records on communication and consultation with employees and stakeholders (inspection agencies, specialist professional engineers, authorities, designers and manufacturers);
- l) Operation and maintenance records;

- m) Training records;
- n) Drill reports;
- o) Inspection and audit records;
- p) Incident and investigation records;
- q) Performance monitoring records;
- r) Patron management procedures;
- s) Emergency response procedures and programmes;
- t) Management review.

## **10.2 Document Information**

The control of safety-related procedural documents is essential to ensure that they are reliable, valid, and an authentic source of information.

This involves the following principles: (refer to example 10.1)

- a) A document should carry information showing:
  - Its identity: document name, and number;
  - The issuing and approval authority;
  - Its scope and application; and
  - Its revision history with revision number and date of revision and effective date.

### EXAMPLE 10.1

#### Document Headings

<<SERIAL NUMBER>>

<<ORGANISATION NAME>>

<<TITLE OF PROCEDURE>>

<<BODY OF PROCEDURE>>

Procedure Name:	
Scope & Application:	
Effective Date:	
Date(s) of Revision:	
References:	
File Location:	
Drafted By:	
Approved By:	

- b) A circulation list for controlled copies should be maintained so that updates and revisions can be circulated to all copy-holders.
- c) The document should be withdrawn promptly when it has been superseded or becomes obsolete.
- d) Controlled documents should be clearly identified and kept updated at all times.

Documents should be legible, easy to locate and accessible. It is important that documentation is proportional to the level of complexity, hazards and risks concerned and is kept to the minimum required for effectiveness and efficiency.

The level of details and complexity of the amusement rides safety management system, the extent of documentation and the resources devoted to it depends on a number of factors, such as the scope of the system, the size of the ride and the nature of the rides

## Bibliography

- [1] Amusement Rides Safety Act (Chapter 6A) and its subsidiary legislations
- [2] Singapore Standard SS506 Part 1 and 2: 2009, Occupational Safety and Health (OSH) Management System
- [3] Workplace Safety and Health Act (Chapter 354A) and its subsidiary legislations
- [4] CP 79: Code of Practice for Safety Management System for Construction Worksites
- [5] Fire Safety Act (Chapter 109A)
- [6] BS EN 13814: 2004: Fairground and amusement park machinery and structures – Safety
- [7] ASTM Committee F24 Standards
- [8] ISO/DIS 17842: Safety of Amusement Rides and Amusement Devices